Chapter 6:
Land Use

Our Goal:

- **Land use activities are sustainable and support a healthy watershed.**

Key Issues:

1) Land use planning
2) Nonpoint source pollution
3) Stormwater runoff

Land use has a direct and major impact on environmental quality of the Lake St. Clair watershed. Increased impervious surfaces, urban areas and loss of natural vegetation associated with land use changes adversely affect surface water quality and quantity by increasing runoff and associated contaminants. The loss of natural habitat associated with land use change has critically impacted the biodiversity and ecosystems in the watershed.

Land use changes and shoreline protection structures have degraded water quality and the ecological health of Lake St. Clair and the St. Clair River. This impact has occurred as a result of changes not only to the land that borders the lake and river but also to the land within watersheds and along banks of tributary rivers and streams.

Yet, in spite of stresses caused by historic and present conflicting land and water uses, Lake St. Clair and the St. Clair River continue to be viable environmental and economic assets and important recreational resources. Typically, more walleye, bass, muskellunge, and sunfish are harvested from Lake St. Clair each year than from any of the other Great Lakes or connecting channel, and the region claims the greatest concentration of registered boats in Michigan.

Because of the economic, environmental and recreational benefits, new developments should incorporate sustainable land use principles to balance future development with water quality and habitat management efforts. Best management practices will also be needed to address issues associated with existing development

This chapter offers "state of the land" information that summarizes past, present, and future land use issues affecting the St. Clair River and Lake St. Clair and provides recommendations for addressing key issues in the U.S. portion of the watershed.

Historic Land Use Patterns

United States: The U.S. portion of the Lake St. Clair watershed was initially settled because the St. Clair River and Lake St. Clair provided numerous resources, including a transportation corridor and an abundance of fish and wildlife. Throughout the1800s settlers changed the land from primarily deciduous forests and lakeplain prairies into land cleared for agriculture. The lake and river continue to serve as an important regional transportation corridor. In the late 1800s two significant developments occurred that led to rapid alterations in the land use patterns: 1) the passage of the Swamp Lands Act of 1850, and 2) the introduction of new technology that vastly improved transportation.

For many years, access to the land was limited by the very nature of the property. In 1815, the U.S. Surveyor General reported that a large part of the southeastern region of Michigan was a swamp and practically worthless. As a result of this "finding," the Swamp Lands Act of 1850 provided that the federal government would offer, at no cost, swampland to individuals if they agreed to drain the land and develop it into a useful parcel. This law stimulated settlers to drain and fill vast areas of wetlands along the St. Clair River and Lake St. Clair. By 1873, the land between the Detroit and Clinton rivers had been almost entirely converted to agriculture.

In turn, improved transportation made the drained "usable" land even more accessible. The advent of electric and steam railways, along with a dredged shipping channel through Lake St. Clair, led to increased human population, multiple private and public recreational activities, and industrial development along the St. Clair River. Industries represented there included chemical, salt, lumber, and oil companies.

Interestingly, the lower reaches of the St. Clair River and Lake St. Clair remained generally unaltered until the 1900s, when highway and road construction, particularly in Michigan, facilitated low-density residential and commercial development. This urbanization intensified after World War II and, by the mid-1970s, much of the Michigan shoreline of Lake St. Clair was the site of homes and small businesses.

Canada: Prior to European settlement, the southern Ontario landscape was primarily forest with some tallgrass prairie and large areas of wetlands that included wooded swamps.

From about AD 900 to the initial European contact, the presence of Aboriginal peoples had a limited impact on the ecosystem of the Lake St. Clair watershed. Their agricultural society involved regular 10 to 30 year cycles of clearing new locations. Farming based on corn (and later squash, beans, sunflowers and tobacco) supported large villages.

Early European settlers recognized the potential for harvesting lumber and the ecosystem began to change as the mature forest was harvested. Access to water transport to float logs and ship timber made the larger watercourses a primary focus for the lumber industry and subsequent agricultural development. Settlers viewed forests more as impediments to development rather than a resource. If a tree was not fit for square timber, it was burned for ashes that were sold for the manufacturing of potash. Mechanization and the development of new farm equipment in the latter part of the 1800s and early 1900s hastened the process of deforestation and conversion of natural landscapes to farmland.

Over a period of 100 to 150 years, forest, swamp and prairie lands were converted into a rural agricultural landscape. In the 1880s, the construction of intricate farm and township drainage systems under the Ontario Drainage Act converted many of the watershed wetlands to some of the most valuable muckland farmland in Canada. Selective re-flooding of some of these mucklands in the fall provides valuable hunting and is a tourist attraction for many American visitors. This has a positive affect on the local economy. Although this conversion to agricultural land impacted the ecosystem, the tilled land still remains the mainstay of the local economy. At this time, the majority of the tall grass prairie was converted to farmland. By the early 1900s, more

than 90 percent of the original woodlands had been converted to non-forest land use, primarily agriculture. In some parts, tree cover is only two percent of the land use.

Urban settlement was part of the rural-agricultural development throughout the 1800s. Successful farming resulted in the need for grist (flour and feed) mills, distilling and brewing, and early textile (wool and flax) manufacturing facilities to convert farm products into commercial goods. A number of villages, towns and cities were developed within the watershed. Urban development often started at strategic river crossings and at mill sites where the availability of waterpower contributed to industrial development. Small plants that began by manufacturing farm equipment were often the start of larger industrial development that led to employment and residential growth for a community. London, the largest Canadian city in the Lake St. Clair watershed, grew in association with several mill sites located along both the north and south branches of the Thames River.

Water transportation supported urban development and most early urban centers began as strategic trans-shipment points. The pattern of urban development in southwestern Ontario owes much to the availability of water for transport. Rail transport and more recently road transport have replaced the water transport system that served early settlers. The rail lines and major roads were built in large part to connect the urban communities that had become established based on water transport and power.

A notable exception to agricultural-based industry was the development of the early petroleum industry in Lambton County. Beginning at Oil Springs and Petrolia in the 1860s, the oil industry in Ontario grew and prospered. Water was an important component of major refinery operations developing in Sarnia where water transport was available and there were good water supplies for industrial operations.

The presence of excellent transportation routes in combination with oil and salt resources led to development of Lambton County chemical industries. Most of southwestern Ontario lies over a huge salt bed that was exploited by Dominion Salt in Sarnia from1903 until the early 1960s. World War II resulted in the construction of a synthetic rubber plant to provide a replacement for natural rubber supplies.

Following the war, new chemical industries were built to supply plastic. The discovery of oil in Alberta provided a renewed source of crude oil and was to have a profound effect on the St. Clair region. A pipeline from Alberta to Lake Superior allowed tankers to carry this new oil supply to the refineries that were being expanded and modernized. The availability of feedstock from the refineries in turn attracted new industries to the area. Salt was a component of some of the processes and "caverns" developed in the salt beds have been used for storage of natural gas and hydrocarbons for over 50 years. Over the course of time, the petrochemical complex located along the St. Clair River became collectively known as "Chemical Valley."

Land Use Trends

While the initial land development was comparable in both Michigan and Ontario, there are now significant differences in the land use patterns in the U.S and Canadian watersheds. In Michigan, there is a larger population and associated urban development. In Ontario, agriculture still dominates the watershed area with

concentrations of urban development at certain locations. Future growth and development predictions are discussed in the following section.

United States: Land use is changing in Southeast Michigan. Between 1990 and 2000, developed land increased 17 percent, which caused a corresponding decline in woodlands, wetlands, grasslands, and shrub land (see Table 6-1). This increase in developed land - which includes residential, commercial and industrial sites - is due to a variety of demographic and economic factors, including population growth, rising incomes, increases in employment, among others.

Table 6-1: Land Use Changes in Southeast Michigan, 1990-2000

	Land use (in acres)			
Developed Land	**1990**	**2000**	**Change**	**Percent Change**
Residential	633,200	754,300	121,000	19 percent
Nonresidential	303,500	341,700	38,200	13 percent
Subtotal Developed	**936,700**	**1,096,000**	**159,300**	**17 percent**
Undeveloped Land	**1990**	**2000**	**Change**	**Percent Change**
Agricultural	1,074,800	934,000	-140,800	-13 percent
Other, Undeveloped	937,500	919,000	-18,500	-2 percent
Subtotal Undeveloped	**2,012,300**	**1,853,000**	**-159,300**	**-8 percent**
Total	***2,949,000***	***2,949,000***		

Source: Southeast Michigan Council of Governments (SEMCOG)

One important factor in the increase in developed land is population growth. Between 1990 and 1999, the areas of greatest population increases were St. Clair Township in St. Clair County and Chesterfield Township (New Baltimore) in Macomb County, both with over 30 percent growth. Table 6-2 shows the total U.S. county population changes with detailed changes presented for those townships adjacent to Lake St. Clair or the St. Clair River.

Between 1990 and 1999, St. Clair County experienced 11.09 percent growth with an average growth of 15.44 percent in those townships adjacent to the water. The next thirty years are expected to result in continued growth for St. Clair County with population increases over 20 percent, including an increasing population in the 65 and over range. Significant increases are expected in all but one of the waterfront townships in St. Clair County with Port Huron Township experiencing the only decline.

Macomb County experienced 10.41 percent growth between 1990 and 1999 with an average growth of 15.44 percent in those townships adjacent to the water. The next thirty years are expected to result in continued growth for Macomb County with population increases near 20 percent, including an increasing population in the 65 year and over range. Over a 65 percent increase in population is expected in Chesterfield Township, with an over 80 percent increase expected in New Baltimore, while the population of the City of St. Clair Shores is expected to decline.

Oakland County experienced a gain of less than 10 percent during the 1990-1999 period and is expected to gain approximately 11 percent by 2030.

Wayne County has remained relatively stable between 1990 and 1999 with slight declines expected over the next thirty years.

Table 6-2 - U.S. Project Area Population

County	Township/Area	Population 1990	1999	Change in Population	Forecasted Growth by 2030[1]
St. Clair		145,607	161,755	11.09 percent	23.8 percent
	Burtchville	3,547	3,976	12.09 percent	48.0 percent
	Fort Gratiot	8,958	10,364	15.70 percent	28.4 percent
	Port Huron	7,642	8,448	10.55 percent	-8.7 percent
	Marysville	8,450	9,560	13.14 percent	16.8 percent
	St. Clair	4,369	5,885	34.70 percent	11.2 percent
	China/E. China	5,800	6,771	16.74 percent	25.7 percent / 13.6 percent
	Cottrellville *(Marine Cy)*	3,212	3,716	15.69 percent	27 percent
	Clay *(Algonac Cy)*	8,786	9,216	4.89 percent	22 percent
Macomb		717,400	792,082	10.41 percent	18.1 percent
	Chesterfield *(New Baltimore)*	25,906	34,409	32.82 percent	66.2 percent *(83.6 percent)*
	Harrison	24,657	25,602	3.83 percent	1.7 percent
	Cy of St. Clair Shores	68,300	65,333	-4.34 percent	-12.8 percent
Wayne		2,111,687	2,106,495	-0.25 percent	-2.3 percent
	Grosse Pte	2,868	2,847	0.74 percent	-6.6 percent
	Grosse Pte: Cy/ Woods/ Farms/ Park	46,675	46,382	0.63 percent	-1.3 to -11.1 percent
Oakland		1,083,592	1,179,978	8.90 percent	11.7 percent

SEMCOG 2030 Regional Development Forecast, RDF, Population by Age Group by Community, September 2002.

Thus, continued increases in population, particularly near the shoreline, are expected over the next 30 years with growth primarily in the mid- to northern segments of Lake St. Clair and the southern segment of the St. Clair River. Land use changes, specifically increases in developed land and loss of undeveloped land, are expected to continue as population increases in the region.

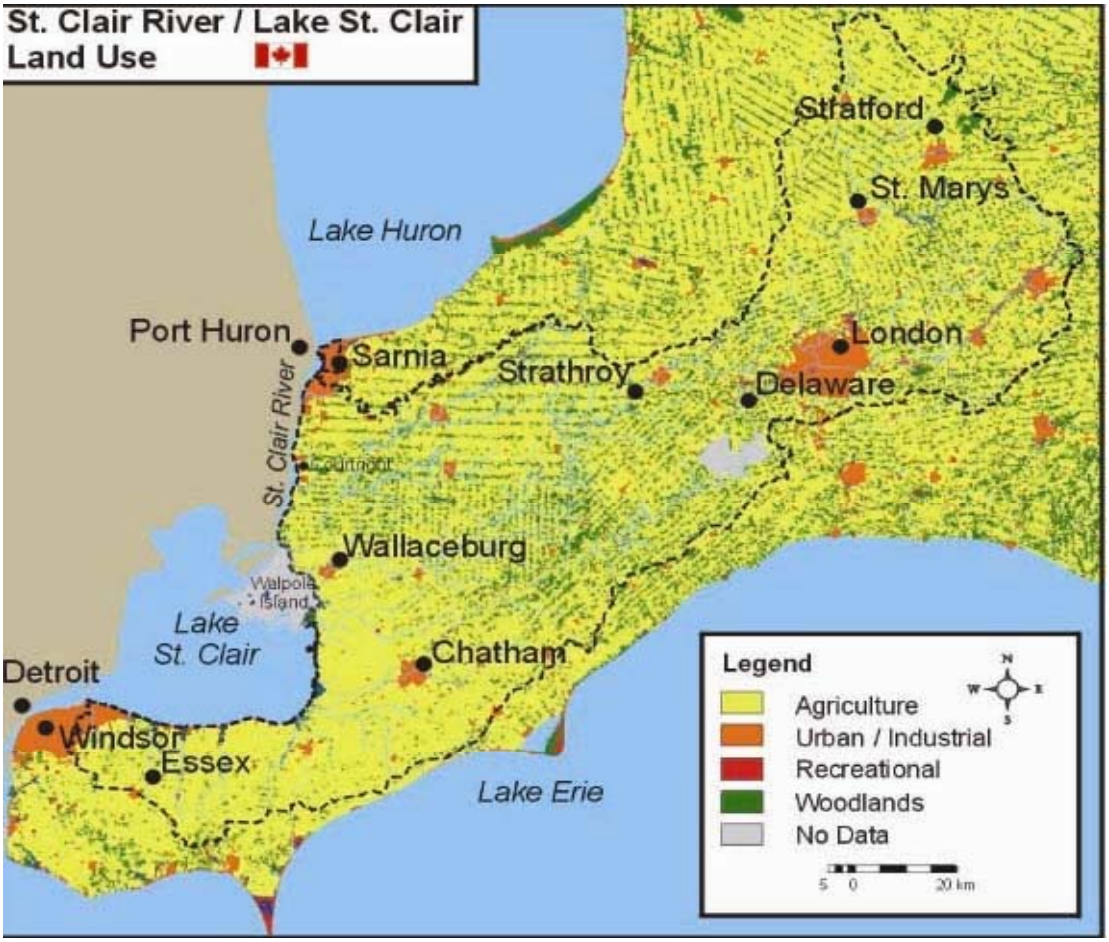
Population growth is not the only factor influencing changes in land use. The combined effect of increasing population, higher incomes, more jobs, lower density development, and additional households all play a role in changing land use and increased development.

Canada: Development to support agricultural, residential, industrial, commercial, recreational and other human activities has had a dynamic effect on the landscape of southwestern Ontario. Today, agriculture is the dominant land use and about 75 percent of the land in the watershed is rural farmland. Approximately 13 percent of the

land is urban, including the rail and road land transport systems. Only about 12 percent of the watershed remains as woods or wetlands. Based on information obtained from the Ontario Ministry of Agriculture and Food, Figure 6-1 provides an overview of land uses for the municipalities in and around the Lake St. Clair watershed.

Over the five-year period between 1996 and 2001, the overall growth rate in the Canadian portion of the Lake St. Clair watershed area was approximately half the provincial average of 6.1 percent. Only Essex County (7 percent) had a growth rate that exceeded the provincial average. Lambton County (-1.6 percent) and the Municipality of Chatham-Kent (–1.8 percent) experienced a reduction in their population. Middlesex, Perth, Oxford and Elgin Counties had growth rates that ranged from 2.2 percent to 3.5 percent.

Figure 6-1: Canadian Land use patterns



Source: Modified from the Ontario Ministry of Agriculture and Food Agricultural Resource Inventory, 1983.

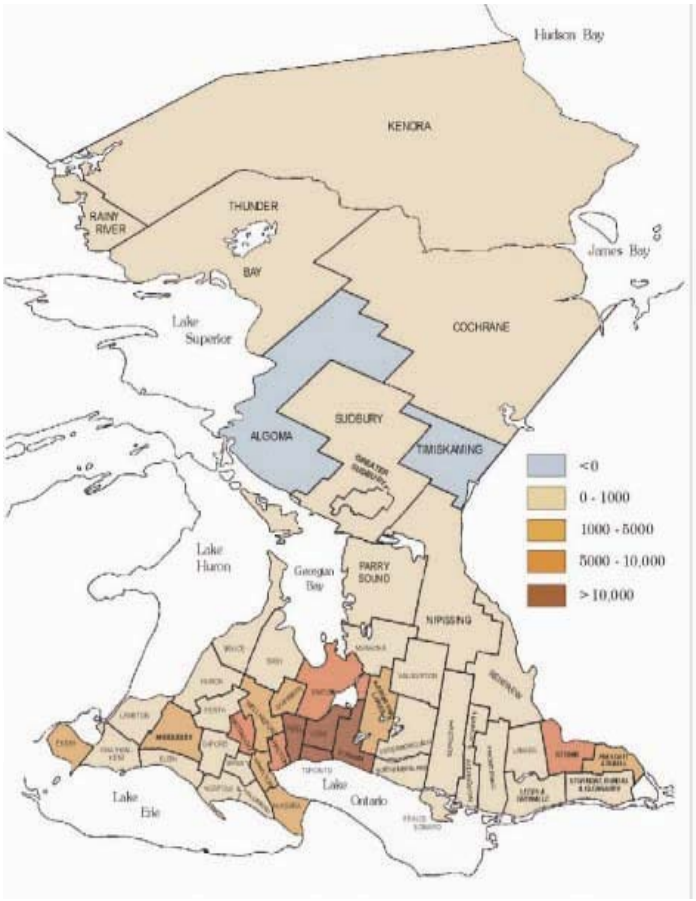
Today, the population of the Province of Ontario is 11.4 million, over one-third the population of Canada, with a large part of the population in the Greater Toronto Area (GTA). An overview of the "Population Growth per Year" for the period from 1999 to 2021 is shown in Figure 6-2 as projected by the Ontario Ministry of Finance. Major growth in Ontario is projected to continue to occur outside the Lake St. Clair watershed. Of the eight counties that are (partially) in the watershed, six are projected

to have growth of less than 1,000 people per year while two counties are expected to grow at rates of less than 5,000 people per year (see Figure 6-2).

The Windsor-Essex Regional Analysis Report (2002) produced by the Ontario Ministry of Municipal Affairs and Housing describes socio-economic, land use and economic trends, predicting a moderate level of growth for this region. The combined population of the City of Windsor and the County of Essex was predicted to increase from 350,329 in 1996 to between 400,949 and 440,867(14 to 26 percent) by the year 2016. The municipalities of LaSalle, Tecumseh and Lakeshore are expected to be the highest growth areas.

While Lambton County has experienced a slight decline in population, the Lambton County Official Plan projects that the county population could reach 142,000 by the year 2016. The Municipality of Chatham-Kent is in the process of developing a new Official Plan for the combined municipality, established in 1998 by the amalgamation of 23 municipalities. A projection of the future population for Chatham-Kent was not available at the time of this report but the population growth rate should be similar to Lambton County.

Figure 6-2: Canadian Population Growth per Year as projected by Ministry of Finance, 1999-2021



The London Regional Analysis Report (Ontario Ministry of Municipal Affairs and Housing, 2002) reported on trends for the City of London and the surrounding counties of Perth, Oxford, Middlesex and Elgin and predicted a similar moderate growth of between 19 percent and 22 percent over the 25-year period between 1996-2021. The projected rate of growth based on the highest predictions would result in an overall population increase from 638,023 (1996) to 822,622 (2021).

The projected growth in population for the area's municipalities indicates that there will be limited urban land development demands over the next decade. Most of the land in the watershed will likely remain as agricultural/rural.

Land Use Impacts

Land use has a direct and major impact on environmental quality. Water quality is adversely impacted due, in part, to increased soil erosion and sedimentation from construction activities, increased stormwater runoff due to increased impervious surfaces, and loss of wetlands and woodlots that help filter runoff. Programs are needed to help mitigate these impacts and to manage growth in the region.

In Ontario, the impacts of agricultural land development dominate the tributaries of the watershed, while the impacts of residential and industrial development are concentrated in areas of past and current growth. For example, the heavily concentrated industrial and residential development along the upper portion of the St. Clair River produced water quality and sediment problems that have been the focus of the St. Clair River Remedial Action Plan. The largely rural Lake St. Clair watershed is impacted by agricultural development with some urban development.

The following pages describe the key issues related to land use and land use changes in the watershed. The discussion is organized around major land use types in the watershed:

- Agriculture
- Residential
- Industrial
- Recreation and open space
- Natural habitat areas

Agriculture

Agriculture has had measurable environmental impacts on Lake St. Clair and St. Clair River tributaries. These impacts include increased nitrates in Canadian tributaries, bacterial contamination in U.S. and Canadian tributaries, high nutrient levels from fertilizers, and erosion from unrestricted animal access to watercourses.

United States: Agriculture is not a major land use in the Michigan portion of the Lake St. Clair watershed. Farmland is being reduced and there are fewer and fewer farms. Agricultural lands are being converted to developed land. Many of the agricultural areas in St. Clair County have become hobby farms rather than cropland. Between 1990 and 2000, agricultural land decreased in Southeast Michigan by 13 percent. Table 6-3 shows the loss of agricultural land by county between 1990 and 2000.

Table 6-3: Lands in Active Agriculture by County, Southeast Michigan, 1990-2000

	Agricultural Land (in acres)			
County	**1990**	**2000**	**Change**	**Percent Change**
Macomb	104,800	87,100	-17,700	-17 percent
St. Clair*	264,500	238,300	-26,200	-10 percent
Oakland*	71,300	53,900	-17,400	-24 percent
Wayne	46,600	26,600	-20,000	-43 percent

* For these counties, numbers are estimates based on partially complete land use update.
Source: SEMCOG

Canada: Agriculture dominates the landscape in southwestern Ontario and is the number one employer in the watershed. Agriculture is expected to continue to be the major land use over the next decade. The major impacts of agriculture have been the removal of natural habitat caused by the cutting of forests and the draining of the catchments, including wetlands, to develop farmland. Increased erosion, runoff and the associated discharges of contaminants, such as bacteria and nutrients, are problems that impact the watercourses. Other issues such as the use of pesticides (e.g. insecticides and herbicides) raise concerns.

The agricultural landscape is changing from small parcel farms to fewer larger parcel farms. There continues to be a demand to convert woodlot and wetland areas into productive farmland. In addition to the disruption of the hydrologic cycle, recent dry weather years have exacerbated the problem by increasing the demand for water to irrigate crops. This can be a concern during low water flow conditions in area watercourses.

Some changes are helping to mediate these problems. The use of no-till and low-till farming techniques is increasing and this helps to reduce soil erosion. Several soil and water conservation programs, such as Healthy Futures, Environmental Farm Plan and the Great Lakes Sustainability Fund, encourage the use of Best Management Practices to improve local water quality and habitat. The new Ontario Nutrient Management Act is expected to improve water quality by improving the use and handling of manure and other fertilizers and requiring buffers adjacent to watercourses.

Residential

United States: Construction of ever-increasing single and multi-family residences impacts the land in many ways.

Rooftops and concrete driveways, sidewalks, and parking lots are impervious surfaces that cause rainwater and snowmelt to skim across the land to the nearest storm sewer, carrying contaminants such as suspended solids, automotive oil, road salt, fertilizers, and litter. Impervious surfaces also add to runoff volume that flows into tributaries or directly into the St. Clair River and Lake St. Clair. This increased volume, with inherently faster currents, leads to increased flooding, soil erosion, and sedimentation while also negatively affecting habitat quality and aesthetics. Expanded development in many Lake St. Clair subwatersheds has resulted in wider, straighter, and deeper drainage channels, which are intended to meet increased stormwater management needs but actually worsen runoff problems.

Residential sewer service and onsite sewage disposal systems can also be problematic. The clay soils found in many areas in the Lake St. Clair watershed are generally impervious in nature; this limits their capability to adequately accommodate onsite septic tanks and tile fields. Yet, the need for these types of sewage disposal systems remains because the rural nature of much of the watershed does not lend itself to adequate and economical public sewer systems. As a result, onsite systems require special engineering and careful installation. Even so, this area's impervious soils cause higher failure rates and shorter system life expectancies than areas with pervious sand and gravel soils. Failed septic systems result in increased bacterial and nutrient contamination of both groundwater and surface water.

Additionally, the proliferation of small lagoon systems and "package wastewater treatment facilities" discharging to surface waters within the watershed is a concern for many of county and local government officials. Increased use of these facilities can result in degradation of local and watershed-wide water quality if the operation and maintenance of the facilities is not closely monitored and regulated, and if the discharge is not well coordinated to alleviate cumulative affects within the receiving streams.

Canada: In the past, residential growth led to untreated or poorly treated sewage being discharged into local watercourses. Bacterial contamination, increased oxygen

demand, and excessive nutrients caused water quality problems throughout the watershed area. The common use of combined storm and sanitary sewers in municipalities also resulted in the discharge of untreated sewage during larger storm events. Other issues associated with residential development include the destruction of natural habitat for housing development and the resulting discharge of high concentrations of sediments and other contaminants (e.g., oil, salt and fertilizers) in increased volumes of stormwater runoff.

Over the past 50 years, increased government regulation has resulted in enhanced municipal sewage treatment, control of combined sewer discharges, the use of stormwater retention/treatment facilities and improved private sewage treatment systems. Faulty septic systems in some urban and rural areas have resulted in inadequate treatment of private sewage and the need for corrective action. Installing new sanitary sewers and repairing individual systems have addressed some problem areas. Routine sampling and several studies have found that watersheds with faulty septic systems can lead to beach closings along their tributaries. However, the impacts of faulty septic systems on the waters of Lake St. Clair are difficult to quantify. The sources and impacts of bacterial contamination are discussed in more detail in Chapter 3 and Chapter 5.

Industrial

Industries on both sides of the St. Clair River include petroleum refineries, organic and inorganic chemical manufacturers, paper companies, salt producers, and thermal electric generation facilities. The majority of these heavy industrial sites are located in Ontario, downstream from Sarnia. In contrast, facilities along the Lake St. Clair shoreline are considered commercial and light industrial.

Historic discharges from industrial sources have had severe impacts on the local watercourses. Industrial impacts on the river and lake today are generally the result of these historic practices that resulted in residual contaminated sediment. The contaminated sediment sites in the river that require remediation have been identified in the St. Clair River Remedial Action Plan. Although data from the Clinton River and tributary streams to Lake St. Clair show elevated contaminants that may be the result of industrial discharges within those watershed areas, the sediment contamination sites have not been well defined. Sites in the lake that may need remediation are even less well defined and additional sediment characterization in the lake and tributaries is necessary.

The potential for a new accidental spill or leakage still exists due to the location of industrial sites along the shoreline. Therefore, U.S. and Canadian laws require particular industrial facilities to have spill containment plans and to practice spill containment exercises. Likewise, in both Canada and the United States, laws require that a spill be reported to the appropriate state/provincial, federal and local government agencies that, in turn, notify other governmental units, water treatment plants, and emergency personnel that might be impacted by the spill. Government agencies have established an international notification system to share information on spill incidents.

Canada: As with municipal sewage, increased government regulation and voluntary actions have reduced the contaminant concentrations and loads discharged from industrial sources across the Lake St. Clair watershed. Larger industries with

significant wastewater discharges have been the focus of provincial regulatory controls under the Environmental Protection Act and federal controls such as the Petroleum Refinery Liquid Effluent Regulations.

New industries and expansion of existing industries are subject to stringent government regulations and controls to prevent adverse environmental impacts. Contaminated sediments from past discharges and the brownfield sites of former industries are issues of concern. The St. Clair River RAP identified areas of sediment contamination that impact Lake St. Clair and require remediation. In addition, the Detroit River RAP indicates that contaminated sediment in the Detroit River may have an impact on the Lake St. Clair fish community. Additional information is available at a number of government web sites. There are several industrial brownfield sites within the Lake St. Clair watershed. New provincial legislation may help municipalities clean up and re-develop these sites.

Recreation

Extensive park systems, beaches, campgrounds, and marinas are located throughout the St. Clair River and Lake St. Clair watersheds. Recreational land uses can have both adverse and beneficial impacts. Cottages, marinas and boat ramps can adversely impact shoreline wetlands by eradicating the natural habitat. However, public interest in using the land for recreational purposes helps support protection and restoration efforts.

United States: A recent inventory of recreation and open space areas by the Southeast Michigan Council of Governments (SEMCOG) shows that 217,000 acres in southeast Michigan (12 percent of the undeveloped land) are dedicated to recreation and open space (see Table 6-4 for a summary of the inventory findings). SEMCOG estimates that undeveloped land decreased eight percent in the 1990s. A major challenge for the future will be to increase the preservation of open space and recreational lands in the face of increased developed and declining undeveloped land.

Table 6-4: Lands in Recreation and Open Space, Southeast Michigan, 2002 Source: SEMCOG

Types of Recreation and Open Space Lands	Land Area (in acres)	Percent
State Parks, Recreation and Game Areas	87,000	40%
Metro Parks	21,700	10%
County Parks	13,000	6%
Municipal Parks	27,300	13%
Nature Preserves. Reserves. Trails	8,700	4%
Private Camps or Campgrounds	7,000	3%
Private Recreation	11,500	5%
Golf Courses	28,500	13%
Other	13,000	6%
Total	217,700	100%

Open space and recreation preservation should be part of the master planning for all the governmental units within the watershed and coordinated among these entities. An environmental inventory should be conducted within the watershed to define environmentally sensitive areas and prioritize these areas for future acquisition by the local units of government so these areas can be protected in the public trust and provided as controlled public access sites as appropriate. A recreational master plan

should be developed that would include methods for procuring land along riparian corridors and shorelines. Recreational planning needs to be considered in all development. The unique environment associated with Lake St. Clair and the St. Clair River needs to be protected and enjoyed by everyone who resides in or visits the watershed area.

More information about recreational boating and boating access can be found in Chapter 7.

Canada: Recreational use is increasing as the demographics of the watershed population changes. Walkways, paths and associated parking lots often intrude into the riparian zone replacing vegetation and increasing stormwater runoff. At the head of the St. Clair River, public access is available via walkways and parking lots along the Lambton Area Water Plant property and the Village of Point Edward Waterfront Park.

Along the St. Clair River, the St. Clair Parks Commission, established in 1966 by the Province of Ontario, provides a park system of 18 facilities and over 500 acres of parkland. The Commission has 15 day-use parks that provide free public access along the scenic St. Clair River. These parks include the City of Sarnia's Centennial Park that was developed on restored industrial lands along Sarnia Bay.

There are 13 marinas located along the Canadian shores of the St. Clair River and Lake St. Clair. Over 2,300 boat slips are available and 10 boat launches along the shores of the lake and river give boaters access for daily excursions. The Sarnia Bay Marina has approximately 190 transient slips and the municipal docks at Wallaceburg and Chatham have facilities to accommodate over 150 transient boats. In addition to the marinas and public docks, private facilities and docks located along the shoreline give cottage and homeowners sites to moor their boats. The impacts of recreational boating are discussed in Chapter 7.

Natural Habitat Areas

In 1995, forested land and wetlands made up a small fraction (approximately 14 percent) along the Michigan shoreline of Lake St. Clair and the St. Clair River. Sixteen percent of the land within the watershed in Michigan was forested. The largest freshwater wetland in the Great Lakes, the St. Clair Delta, is located at the mouth of the St. Clair River.

As discussed earlier, wetlands on both sides of the watershed historically have been lost to agriculture and development (Table 4-2 in Chapter 4 shows the reduction of wetlands in the U.S. portion of the watershed from 1873 to 1973.) These wetland areas serve as natural purifiers that remove contaminants from runoff, preserve water quality, and provide unique habitat for waterfowl and some reptiles and mammals. Therefore, continued loss of wetlands along the lake shoreline and throughout the watershed's interior will have both short- and long-term impacts on environmental quality.

While "wetlands" can be created to "compensate" for lost wetland areas, mitigated areas tend to offer less effective filtering capability and less desirable habitat than the original wetlands. Clearly, the most optimal scenario is to preserve existing wetlands.

Canada: In southwestern Ontario, agriculture, urban growth and recreational development have resulted in only remnants of forest, wetland and prairie remaining. Information on the extent of the changes to natural habitats and the associated impacts are outlined in Chapter 4. Figure 6-1 provides an overview of land usage in the Lake St. Clair watershed.

The Provincial Policy Statement says: "Development and site alteration will not be permitted in significant wetlands south and east of the Canadian Shield and significant portions of the habitat of endangered and threatened species." The largest remaining wetland areas are in the St. Clair River Delta and along the eastern shore of Lake St. Clair.

The Lambton County Official Plan includes a "Natural Heritage System" with a goal of protecting and restoring natural heritage corridors that will promote and protect the biodiversity of species found within the local ecosystems. The intent of the Official Plan is to direct development away from the Natural Heritage System.

Findings and Recommendations

The U.S. recommendations regarding Lake St. Clair are presented as part of this management plan. Canadian recommendations for Lake St. Clair will be developed following public review of and input into the management plan. In addition, the St. Clair River has a set of binational goals and objectives that were established as part of the binational St. Clair River RAP (see www.friendsofstclair.ca).

Many Lake St. Clair issues are already being addressed, at least in part, by existing efforts to mediate problems in the watershed tributaries and the Great Lakes. Both public input and existing objectives will be important in developing the binational recommendations for Lake St. Clair.

United States: Population growth, coupled with higher incomes, more jobs, lower density development, and additional households all play a role in changing land use and increased development in Michigan. Land development and loss of open space and agricultural land have a direct and major impact on environmental quality. Water quality is adversely impacted due, in part, to increased soil erosion and sedimentation from construction activities, increased stormwater runoff due to increased impervious surface, and loss of wetlands and woodlots that help filter runoff.

Land use impacts transcend the major topics presented in other chapters in this management plan. The other chapters describe many of the U.S. programs and initiatives that address land use impacts in the watershed. The recommendations that follow focus on three key land use issues that are not specifically addressed in other portions of this document:

- Land use planning
- Erosion and sedimentation
- Stormwater runoff

Land Use Planning

Managing growth and land development is a key issue for Southeast Michigan. There are hundreds of communities in Southeast Michigan that regulate the land development process. Local government, through planning, zoning, and development reviews is the primary regulators of land use. While planning can be coordinated with neighboring communities, the primary decision makers are local governments.

There are numerous land use planning tools and techniques available to local communities that ensure a healthy environment and a healthy quality of life for its residents. Numerous projects and initiatives are currently underway that implement these tools and techniques. These projects include downtown revitalization projects, redevelopment projects, historic preservation projects, new urbanism projects, multi-community planning initiatives, open space developments, and innovative stormwater management and habitat programs, among others.

Managing growth and land development is a key issue for Southeast Michigan. Local units of government within the watershed should incorporate the preservation, protection, and enhancement of the area's habitat and ecological and economic integrity into their comprehensive land use plans.

Land Use
Candidate Management Plan Recommendations for Actions in the U.S. Watershed:

Land Use Planning

6-1. Maintain, on a county and regional level, land use data and information. This should include maps that depict the location of coastal areas, protected and managed areas, and natural features that identify at-risk areas for better protection and management

6-2. Develop and implement regional and local watershed management plans to control, mitigate, and prevent point source and nonpoint source pollution

6-3. Provide technical assistance to local units of government to manage development and natural resources in a sustainable manner through the use of education, incentives, technical assistance, and funding assistance

6-3.a. Increase funds and technical assistance for local government to develop and implement land use plans. Emphasize erosion hazards, floodplain functions, sedimentation controls, habitat protection, and use of natural vegetation as requirements in local zoning and subdivision regulations

6-3.b. Increase funds and technical resources for local units of governments to implement best management practices (BMPs) to protect natural resources, reduce erosion, and reduce nonpoint source pollution

6-3.c. Educate local zoning boards and planning commissions regarding innovative tools to manage development and natural resources in a sustainable manner, such as model ordinances, best management practices, and existing programs that provide technical and cost-share assistance to control and prevent point and nonpoint source pollution

6-3.d. Encourage local zoning boards and planning commissions to establish regulations to limit development in sensitive areas, such as critical habitats and erosion sites

6-3.e. Encourage local zoning boards and planning commissions to incorporate a review of water quality impacts in all projects they review and to deny approval to projects that would significantly degrade water quality or contribute to violations of water quality standards

6-4. Encourage local units of governments to implement tools such as Low Impact Development (LID) and wetland ordinances.

6-5. Minimize traditional techniques of shoreline hardening and encourage alternative approaches that improve fish and wildlife production capacity through habitat protection and restoration

Nonpoint Source Pollution

Nonpoint source runoff is by definition diffuse and consequently difficult to treat and control. As land use changes, the nature of nonpoint source runoff also changes. Undeveloped land is generally more permeable and runoff tends to seep into the ground and enter area streams through groundwater seepage over an extended period of time. Natural wetland areas provide retention and treatment that reduces peak flows and contaminants entering area streams. Developed land has a higher runoff rate since it is more impervious and water flows to area streams faster, and increases the peak flow in the stream. As wetland areas are destroyed, runoff water reaches streams quicker and more contaminated. These higher peak flows, coupled with in-stream changes associated with development such as straightened channels, culverts, and bridge structures, cause accelerated erosion in streams and increase downstream sedimentation. Construction activities disturb the land and generally result in additional accelerated soil erosion and downstream sedimentation.

Development and land use change within the watershed needs to be accompanied by implementation of control measures and treatment processes to prevent degradation of watershed streams as a result of these changes. Some of these treatment and control measures can be structural such as riparian buffer strips and constructed wetlands. There are also nonstructural measures that can be implemented such as public education regarding the use and maintenance of onsite disposal systems and ways to limit fertilizer usage.

All development should include the installation and maintenance of Best Management Practices (BMPs) to control soil erosion and sedimentation. Tributary streams within the watershed should be evaluated to determine where streambank erosion is occurring currently or where there is a high potential for streambank erosion to occur as land use changes affect the stream flow characteristics. As these areas are identified, methods need to be developed and implemented to stabilize the streambanks and prevent erosion and downstream sedimentation. BMPs ranging from soft engineering to armored shorelines need to be investigated and evaluated so the best solutions can be developed and implemented.

Land Use
Candidate Management Plan Recommendations for Actions in the U.S. Watershed:

Nonpoint Source Pollution

6-6. Accelerate implementation of existing incentive programs to reduce nonpoint source pollution

6-7. Require the use of best management practices, such as stormwater control measures, that limit post-development flow rates to predevelopment levels

6-8. Evaluate soil erosion and sedimentation control programs for adequate staffing and enforcement

6-9. Identify and target priority areas for soil erosion and sediment control efforts

6-10. Educate property owners, such as homeowners and farmers, about nonpoint source pollution and encourage them to implement actions to minimize the amount of nonpoint source pollution leaving their property

Stormwater Runoff

Stormwater best management practices limit the detrimental effect of stormwater runoff regardless of land use type. Unfortunately, these practices have traditionally been voluntary. Therefore, all levels of government should institute programs that educate and encourage property owners, especially homeowners and farmers whose land is least regulated by stormwater legislation, to minimize the pollution leaving their property.

Michigan has been delegated authority from the federal government to implement the Phase II stormwater program under the NPDES permit program. This program is designed to improve the stormwater quality from "urbanized areas" such as the municipalities located along the lake and river shoreline. Communities have applied for permits in 2003 and will begin to implement various requirements of the program in 2004. These requirements will include:

- Development of an Illicit Discharge Elimination Program (IDEP) to locate and remove sources of sewage and industrial wastewater connected to the storm sewer system
- Development of a Public Education Program (PEP) designed to inform the public regarding their impacts on the river and lake and how to reduce these impacts through their own actions
- Development of watershed plans for the area's tributaries to the lake and river
- Development of a Storm Water Pollution Prevention Initiative (SWPPI) by each community and county that will establish programs and time frames to implement the recommendations contained in the watershed plans.

Land Use
Candidate Management Plan Recommendations for Actions in the U.S. Watershed:

Stormwater Runoff

6-11. Enforce the requirements of the Michigan General Stormwater Permit and the U.S. EPA Phase II stormwater permit

6-12. Develop and implement Storm Water Pollution Prevention Initiatives (SWPPIs) in all Phase II governmental units in the watershed, including implementation of pollution prevention and good housekeeping practices

6-13. Implement BMPs designed to minimize impacts of new development and redevelopment

6-14. Incorporate findings from the watershed planning efforts into future land use planning to improve stormwater management

6-15. Adopt improved local ordinances, consistent Master Planning, and coordinated zoning

6-15.a. Require infiltration, buffer strips, and other BMPs in developments

6-15.b. Promote innovative site design that reduces the creation of impervious surface

6-15.c. Emphasize stormwater management as requirements in local zoning and subdivision regulations

6-16. Educate property owners, such as homeowners and farmers, about stormwater runoff and encourage them to implement actions to minimize the amount of stormwater runoff leaving their property

Conclusion

In many ways, land use practices underlie the full range of environmental concerns facing the watershed. Like many regions of North America, the St. Clair region is facing patterns of urban sprawl, with increases in commercial and residential land use at the expense of agricultural and undeveloped lands. In addition to being sources of contaminants, developed lands provide poor groundwater recharge and serve to convey contaminants more quickly to waterways. Poorly designed stormwater systems can magnify this problem.

As developed areas are crowding out natural areas, there has been an increased awareness that land use practices impact wildlife habitat, species diversity, and recreational opportunities. The public values the Lake St. Clair watershed for birding, fishing, recreational boating, and beach going, among other things. Land use practices need to be compatible with protecting nature and reducing contamination. This compatibility underscores the need for comprehensive land use planning that incorporates preservation, protection, and enhancement of the area's habitat and ecological and economic integrity.

The recent and continuing trends of rapid growth and development in the St. Clair region underscore the urgency with which these issues must be addressed. The long-lasting nature of land use decisions implies that careful, forethoughtful planning will avoid expensive future corrective actions. Land use patterns determine not only how our communities are structured, but also determine how those communities affect and interact with the natural world. Programs that promote comprehensive and responsible land use planning are needed today to ensure that our interactions with the natural world, and our quality of life that depends on them, can be sustained for the generations of tomorrow.